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Trypetinae (Diptera: Tephritidae) from Madagascar

by

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Eleven species of trypetine Tephritidae are recorded from Madagascar, all described as new: *Hoplandromyia madagascariensis* sp. nov., *Euleia inconspicua* sp. nov., *Hemilea malgassa* sp. nov., *Taomyia pictipennis* sp. nov., *Myoleja andobana* sp. nov., *M. mailaka* sp. nov., *M. perineta* sp. nov., *M. sandrangato* sp. nov., *M. tsaratanana* sp. nov., *Acidoxantha bisinuata* sp. nov., *Notomma munroi* sp. nov. The taxonomic limits of the Afrotropical Trypetinae are discussed.

Three species of Trypetinae have been recorded previously from the Malagasy subregion, one from Réunion (*Hoplandromyia tetracera* Bezzi (Bezzi 1923)) and two from the Seychelles (*Taomyia ocellata* (Lamb) and *Myoleja seychellensis* (Lamb) (Lamb 1914)), but no species has been reported previously from Madagascar. It therefore comes as no surprise to find that the eleven species now known from Madagascar are all undescribed.

Only 31 specimens have been available for study but they are of considerable interest. The names of institutions wherein they are deposited are abbreviated as follows: CAS – California Academy of Sciences, San Francisco; MHN – Muséum National d'Histoire Naturelle, Paris; NCI – National Collection of Insects, Plant Protection Research Institute, Pretoria; NM – Natal Museum, Pietermaritzburg; TAU – Tel Aviv University, Israel. Holotypes of species described by Hancock (1984) are being transferred to MHN.

Keys to the genera and species known to occur in Madagascar have not been provided since the species are readily identifiable from the figured wing patterns and diagnoses.

Family TEPHRITIDAE

Subfamily TRYPETINAE

The taxonomic limits of this subfamily in the Afrotropical Region are not well understood, Cogan & Munro (1980) including in the Trypetinae only *Rivelliomima* Bezzi and an 'undescribed genus'. This latter belongs to the Tephritinae but several unplaced genera referred by Cogan & Munro (1980) to the Acanthonevrinae and Aciurinae appear to belong to the Trypetinae. These include *Notomma* Bezzi and the unplaced species of Aciurinae (which are referrable to the genera *Myoleja* Rondani and *Euleia* Walker), and probably all the unplaced genera near Acanthonevrinae except *Xaniosternum* Enderlein, *Xenodorella* Munro and *Labeschatia* Munro. Genera placed in the Euphrantinae that have rounded abdomens and lack long hair on the pleuroterga (*Afrocne-*

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ros Bezzi, *Ocnerioxa* Speiser and *Ptiloniola* Hendel, but not *Ocnerioxyna* Séguy), together with *Labeschatia*, appear to belong to the Acanthonevrinae. *Xenodorella* and *Ocnerioxyna* are referrable to the Aciurinae, whilst *Xaniosternum* probably belongs to the Euphrantinae.

That *Notomma*, *Euleia* and *Myoleja* do not belong to the Aciurinae is evident from their biologies. The Aciurinae (tribe Aciurini of Cogan & Munro, 1980) infest the flowers of Labiatae, Verbenaceae and Acanthaceae, and the larvae pupate in the flower-head rather than in the ground. The unplaced genera near Acanthonevrinae (with the exceptions mentioned above) also appear to be better placed in the Trypetinae than in the former subfamily. The biology of *Hoplandromyia* Bezzi shows it to belong to the leaf-mining group of genera, close to *Vidalia* Robineau-Desvoidy, whilst *Taomyia* Bezzi appears to be related to the Oriental genera *Anonoia* Walker and *Callistomyia* Hendel. *Myoleja*, *Euleia*, *Vidalia*, *Anomoia*, *Hemilea* Loew and *Acidoxantha* Hendel were referred to the Trypetini by Hardy (1973, 1974). Typical Acanthonevrinae have six scutellar bristles (four in some genera), a tactile aculeus and plumose arista. The Adraminae and Euphrantinae differ from related groups in the presence of long hairs on the pleuroterga and in their elongate abdomen. *Sosiopsila* Bezzi, usually placed in the Adraminae, lacks the pleurotergal hairs and acuminate anal cell and appears to belong to the Phytalmiinae.

Biologically, as in other regions, the Afrotropical Trypetinae have a diverse host range. Genera such as *Euleia* and *Hoplandromyia* are leaf-miners, whilst *Acidoxantha* infests the buds of large flowers, *Zacerata* Coquillett bores in the stems of *Asparagus* (Liliaceae) and *Notomma* forms galls on the twigs of *Acacia* and *Dicrostachys* (Leguminosae). Still others, such as *Myoleja* and *Scleropithus* Munro breed in fleshy fruits. The dividing line between the fruit-infesting Trypetinae and the Ceratitinae is the subject of considerable uncertainty and it may well eventuate that the Trypetinae are polyphyletic, with some geners (e.g. *Acidoxantha*) allied to the Ceratitinae and Gastrozoninae, and others allied to the Acanthonevrinae, Phytalmiinae, Euphrantinae and Adraminae. Alternatively, all these groups may belong to a single subfamily, as suggested by Hardy (1973, 1974).

The precise relationships between the Trypetinae, Ceratitinae, Acanthonevrinae and the largely Oriental Gastrozoninae require further study, but the Gastrozoninae appear to be bamboo-shoot and possibly grass-stem borers, with plumose arista, whilst the Ceratitinae are characterized by having the scutellum more or less swollen. For convenience, the subfamily classification of Cogan & Munro (1980) is followed here pending further study. The Ceratitinae have been dealt with previously (Hancock 1984).

The Afrotropical Trypetinae may be considered to comprise those species which have the arista usually with short pubescence or bare; a row of thin occipital bristles; usually a full complement of head and thoracic bristles although the ocellars may be weak or absent and occasionally some thoracic bristles are absent; four scutellar bristles; pleuroterga bare; a non-tactile aculeus; and a flat, non-swollen scutellum. The larvae infest the fruits, buds, shoots, twigs or leaves of plants other than the Gramineae and generally leave the host to pupate. This concept is in agreement with that outlined by Hardy (1973, 1974) for the Oriental species of Trypetini.

THE MADAGASCAR FAUNA

Eleven Madagascan species, placed in seven genera, fit the concept of the Trypetinae as outlined above. A feature of the Madagascan fauna is its affinities with

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the Oriental and Holarctic Regions. Genera such as *Hemilea* and *Acidoxantha* are largely or typically Oriental, whilst *Euleia* is a Holarctic genus with one species in Africa, and *Myoleja* is well developed in the Holarctic and Oriental Regions and is also represented in Africa. A purely Afrotropical element is present, however, in the form of species of *Hoplandromyia, Taomyia* and *Notomma*.

Genus *HOPLANDROMYIA* Bezzi

This is an Afrotropical genus with three previously described species: *buhri* Hering, *junodi* Bezzi and *tetracera* Bezzi, the latter occurring on Réunion. Until now, the hosts of this genus were unknown but a specimen of the Madagascan species was bred from the leaves of *Canthium (=Plectronia) humberti*, a member of the Rubiaceae.

Hoplandromyia madagascariensis sp. nov., Figs 1–4

This species can be separated from the others in the genus by a combination of yellow scutellum, broad mesopleural stripe and two large, square-shaped hyaline spots in the second costal cell. In addition, the short brown wing bar beyond the stigma does not extend beyond vein R_{4+5} and an oval hyaline spot is normally present in the first basal cell, below the stigma.

The specific name is derived from its country of origin.

MALE. Length of body, 3,5–4,6 mm; of wing, 3,5–4,5 mm.

Head (Fig. 1). Length : height : width: 1 : 1,4 : 1,7; fulvous. Frons narrowing slightly anteriorly, 0,36 times width of head at widest part; bristles black, 3 inferior orbitals, 1 superior orbital; the inferior orbitals arising from tubercles on a carina, situated towards vertex, incrassate, the lower relatively short and thin, the middle long and broad, the upper also long and broad but usually shorter than the middle; the superior orbital lies inside the line of the inferior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles absent; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face unmarked. Antennae shorter than face, fulvous; third segment apically rounded; arista pubescent. Occiput flat, with a row of thin, black occipital bristles.

Thorax. Mesonotum shining dark red-brown to black, with fine pubescence. Pleura fulvous to red-brown, palest anteriorly, except for a yellow stripe from posterior margin of humeral callus to wing base, broadening a little posteriorly. Postnotum shining deep red-brown to black. Scutellum yellow except for a narrow dark red-brown to black basal band, widening a little at sides. Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed on the line of the anterior supra-alars. Legs fulvous, mid and hind femora browner; fore femora swollen laterally, with a row of black bristles beneath; middle tibiae with an apical black spine. Halteres fulvous. Wing (Fig. 2) with vein R_{4+5} setulose, r-m cross-vein beyond middle of discal cell, i-m cross-vein virtually straight; pattern blackish-brown, with two squared hyaline spots in second costal cell and usually an oval hyaline spot in first basal cell below the stigma; small post-stigmal band free or just touching basal dark area at vein R_{4+5} not extending below that vein; anal cell elongate acuminate.

Abdomen. Oval; shining red-brown to black, with fine pubescence and with long setae along apical margins of segments. Male genitalia (Fig. 3) red-brown.

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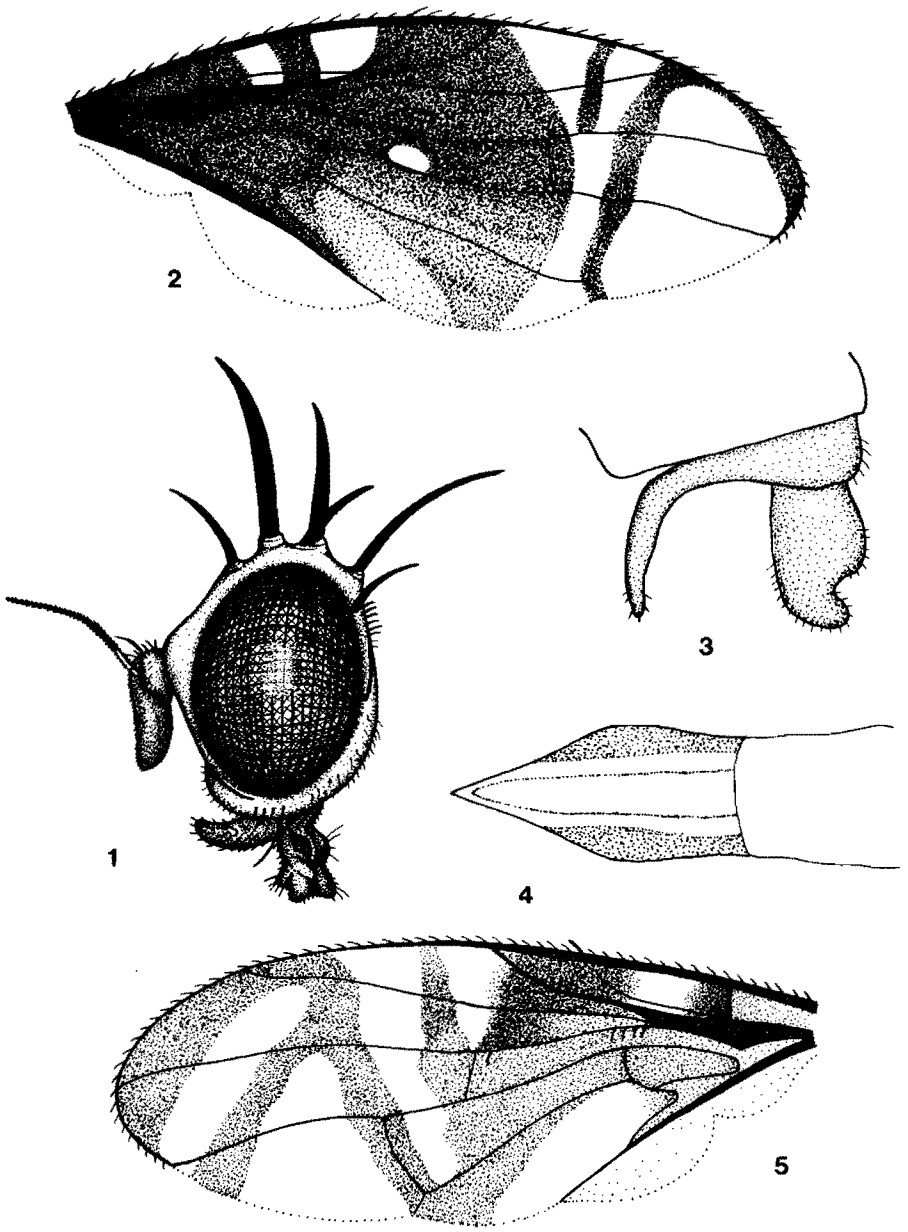

Figs. 1–5. 1–4. *Hoplandromyia madagascariensis* **sp. nov.** 1. Head of male. 2. Wing of male. 3. Lateral view of male genitalia. 4. Aculeus. 5. *Euleia inconspicua* **sp. nov.**, wing of male.

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FEMALE. Length of body, 4,0 mm; of wing, 4,0 mm. Similar to male except inferior orbital bristles not incrassate and in normal position, not on tubercles; fore femora not swollen and all femora fulvous; yellow mesopleural stripe a little broader posteriorly, enclosing lower mesopleural bristle; post-stigmal wing-band partially joined to basal dark area at vein R_{4+5}. Oviscape red-brown, flattened, length 0,25 mm; aculeus (Fig. 4) broad, flattened, pointed at tip.

MATERIAL EXAMINED. Holotype ♂: MADAGASCAR (CENTRAL): Andranotobaka, 1400 m, Ambatolampy district, iii.1957, P. Griveaud; 1 ♂ paratype, same locality and collector but iv.1957; 1 ♀ paratype, Tsimbazaza, Tananarive, coll. Radimby, from mine in leaf of *Plectronia humberti*, pupated 10.v.1960, emerged 31.v.1960 (all MHN); 1 ♂ paratype, Vakoana, 1520 m, Andringitra–Ambalavao, 21–24.i.1958, B. Stuckenberg (NM). (EAST): 2 ♂ paratypes, Perinet (Moramanga district (MHN & NCI); 1 ♂, 2 ♀ paratypes, Perinet, 5.iii.1984, M. von Tschirnhaus, ex mine, emerged 12.iv.1984 (TAU).

Genus *EULEIA* Walker

This is the first record of this Holarctic genus from the Afrotropical Region, although *E. fossataeformis* (Bezzi), comb. nov., described from Malawi, also belongs here. At least some members of the Oriental genus *Acidiella* Hendel appear to be closely related to *Euleia*, and possibly congeneric with it. Species in this genus are known to mine the leaves of Umbelliferae, Rubiaceae and Compositae.

Euleia inconspicua sp. nov., Fig.5

This species resembles *E. fossataeformis* (Bezzi) in wing pattern but the second hyaline indentation beyond the stigma does not reach the hind margin of the wing and vein R_{4+5} does not have a row of setae over most of its length, having only a few setae basally and another below the tip of vein R_1. In this peculiar distribution of setae on vein R_{4+5} it resembles *Acidiella freyi* Hardy from the Philippines, but differs from that species in wing pattern.

The specific name is derived from its small size and nondescript appearance.

MALE. Lenth of body, 2,5 mm; of wing, 2,5 mm.

Head. Length : height : width: 1 : 1,5 : 1,8; fulvous. Frons narrowing slightly anteriorly, 0,33 times width of head at widest part; bristles red-brown, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle red-brown, ocellar bristles weak; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face with a whitish central keel and brownish antennal grooves. Antennae shorter than face, fulvous; third segment apically rounded; arista pubescent. Occiput flat, with a row of thin, red-brown occipital bristles.

Thorax. Mesonotum shining pale red-brown, with fine pubescence. Pleura pale red-brown. Postnotum shining deep red-brown. Scutellum fulvous. Bristles red-brown: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed behind the line of the anterior supra-alars. Legs fulvous; middle tibiae with an apical black spine. Halteres fulvous. Wing

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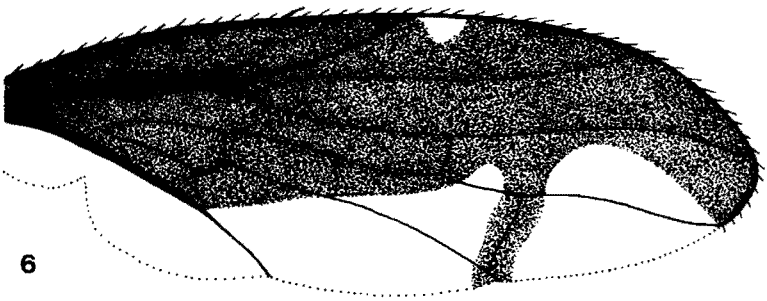

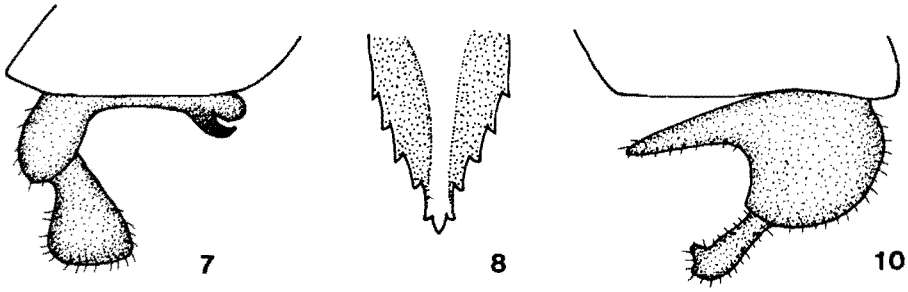

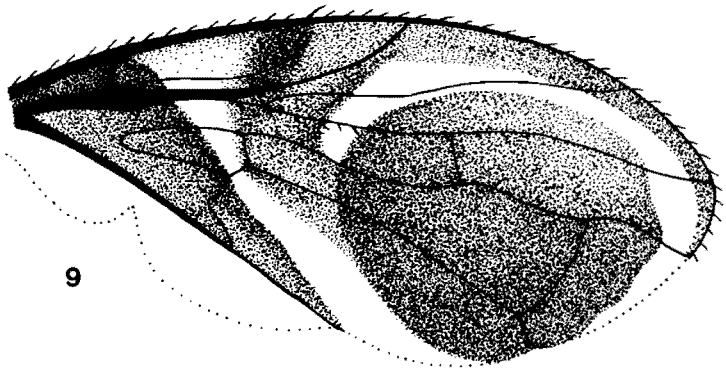

Figs. 6–10. 6–8. *Hemilea malgassa* **sp. nov.** 6. Wing of male. 7. Lateral view of male genitalia. 8. Tip of aculeus. 9–10 *Taomyia pictipennis* **sp. nov.** 9. Wing of female. 10. Lateral view of male genitalia.

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(Fig. 5) with vein R_{4+5} bare except for a few setae basally and 1 seta below the tip of vein R_1, r–m cross-vein beyond middle of costal cell, i–m cross-vein at right angles to vein M_{3+4}; pattern pale brown, becoming fulvous basally; stigma dark brown; a triangular hyaline indentation beyond stigma extending to vein R_{4+5} at r–m cross-vein, a hyaline indentation beyond that extending to vein M_{3+4}, and hyaline indentations in first and second posterior cells extending to veins R_{2+3} and R_{4+5} respectively; base of wing largely hyaline; anal cell short acuminate.

Abdomen. Oval; shining dark brown except fulvous on posterior part of third, median part of fourth and entire fifth segments. Male genitalia not studied.

FEMALE. Unknown.

MATERIAL EXAMINED. Holotype ♂: MADAGASCAR (SAMBIRANO): Mailaka, i.1952, N. L. H. Krauss (NCI).

Genus *HEMILEA* Loew

This Palaearctic, Oriental and South Pacific genus is recorded for the first time from the Afrotropical Region. Host plants have not been recorded for any member of the genus.

Hemilea malgassa sp. nov., Figs 6–8

The wing pattern serves to separate this species from all others in the genus, the hyaline areas extending above vein M_{1+2} and being more extensive than in related species.

The specific name is derived from the Malagasy subregion.

MALE. Length of body, 3,5 mm; of wing, 4,5 mm.

Head. Length : height : width: 1 : 1,5 : 1,7; fulvous. Frons narrowing slightly anteriorly, 0,35 times width of head at widest part; bristles black, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles well developed; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face white, unmarked. Antennae shorter than face, fulvous; third segment apically rounded; arista bare. Occiput flat, with a row of thin, black occipital bristles.

Thorax. Mesonotum shining red-brown, palest medially, darkest dorso-laterally, with fine pubescence. Pleura red-brown. Postnotum shining red-brown. Scutellum whitish-yellow except for a narrow red-brown basal band, widening at sides. Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed a little before the line of the anterior supra-alars. Legs fulvous; middle tibiae with an apical black spine. Halteres fulvous. Wing (Fig. 6) elongate, with vein R_{4+5} setulose, r-m cross-vein well beyond middle of discal cell, i-m cross-vein at right angles to vein M_{3+4}; blackish-brown on anterior part except for a hyaline spot just beyond the stigma, hyaline on posterior part except for a blackish-brown band across the i-m cross-vein, united with the anterior dark area; the posterior hyaline areas extend broadly into the first posterior cell beyond the i-m cross-vein and narrowly into the base of this cell; anal cell short acuminate.

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Abdomen. Oval; shining black with long sparse pubescence and with long setae along apical margins of segments. Male genitalia (Fig. 7) blackish-brown.

FEMALE. Length of body, 3,5–4,0 mm; of wing, 4,5–5,0 mm. Similar to male. Oviscape shining black, conical, length 0,8 mm; aculeus (Fig. 8) broad, flattened, serrate at tip.

MATERIAL EXAMINED. Holotype ♂: MADAGASCAR (CENTRAL): Andranotobaka, 1400 m, Ambatolampy district, iii.1957, P. Griveaud (MHN); 1 ♀ paratype, same data as holotype (NCI); 1 ♀ paratype, Andrianony, nr Manjarivolo, 1650 m, South Andringitra (Ambalavao district), 26.x.–3.xi.1970, Museum Paris Madagascar Centre Mission C.N.R.S., R.C.P. no. 225, light trap (MHN).

Genus *TAOMYIA* Bezzi

This is an Afrotropical genus with two previously described species: *marshalli* Bezzi and *ocellata* (Lamb), the latter occurring in the Seychelles. *T. marshalli* has been reared from *Sanseviera* (Agavaceae), presumably the fruit, by V. G. L. van Someren in East Africa.

Taomyia pictipennis sp. nov., Figs 9–10

This species can be recognized by the yellow presutural stripes on the mesonotum, extending from the mesopleura, and by the complete hyaline wing band extending from before the stigma to the hind margin.

The specific name is derived from its attractive wing pattern.

FEMALE. Lenght of body (excluding ovipositor), 5,6 mm; of wing, 5,6 mm.

Head. Length : height : width: 1 : 1,55 : 1,55; fulvous. Frons with fine pale pubescence, narrowing slightly anteriorly, 0,36 times width of head at widest part; bristles dark red-brown, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle dark red-brown, ocellar bristles well developed; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face unmarked. Antennae shorter than face, fulvous; third segment apically rounded; arista bare. Occiput flat, with a row of thin, red-brown occipital bristles.

Thorax. Mesonotum dark red-brown to brown, with fine pubescence; humeral calli fulvous. Pleura brown except fulvous anterior to mesopleura and a broad, vertical yellow mesopleural stripe, extending across notopleural callus onto mesonotum along suture and ending in a blunt point at end of suture. Postnotum dark red-brown. Scutellum yellow except for a narrow brown basal band. Bristles well developed and dark red-brown: 2 scapulars (middle pair absent), 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 1 mesopleural, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed well behind the line of the anterior supra-alars, closer to the prescutellars. Legs with femora fulvous, tibiae and tarsi pale red-brown; fore femora with a row of black bristles beneath; middle tibiae with an apical black spine. Halteres fulvous. Wing (Fig. 9) with vein R_{4+5} setulose, r-m cross-vein a little beyond middle of discal cell, vein M_{1+2} curved downwards before r-m, i-m cross-vein almost at right angles to M_{1+2}, slightly curved

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outwards; pattern fulvous, becoming darker distally, with a complete hyaline band from second costal cell to hind margin of third posterior cell and a curved hyaline band from first basal cell through submarginal cell to second posterior cell; stigma pale yellow; axillary cell and alula hyaline; anal cell short acuminate.

Abdomen. Oval; red-brown with fine pubescence; sixth segment about half length of fifth, with long dark marginal bristles. Oviscape red-brown, conical, length 0,95 mm; aculeus not exposed.

MALE. Length of body, 4,8–6,6 mm; of wing, 4,5–6,0 mm. Similar to female but abdomen a little more elongate. Male genitalia (Fig. 10) robust, fulvous.

MATERIAL EXAMINED. Holotype ♀: MADAGASCAR (EAST): Andranomandevy, Didy, 1039 m, Ambatondrazaka district, x.1956, E. Raharizonina (MHN). (WEST): 1 ♂ paratype, forêt de Zombitsy, near Sakaraha (Tulear district), 650 m, 16.xii.1959, E. S. Ross (CAS). (SOUTH): 1 ♂ paratype, Betioky, iv.1937, A. Seyrig (MHN).

Genus *MYOLEJA* Rondani

This widespread Holarctic and Oriental genus has not been reported previously from the Afrotropical Region although four species described from Zaire, Malawi and the Seychelles belong in it. These are: *M. atrata* (Munro), comb. nov. (Zaire); *M. cerataex* (Munro), comb. nov. (Zaire); *M. homogenea* (Bezzi), comb. nov. (Malawi) and *M. seychellensis* (Lamb), comb. nov. (Seychelles). The African species were illustrated by Munro (1938).

Hosts for the Afrotropical species have not been recorded, but in America species of *Myoleja* infest the fruits of *Ilex* (Aquifoliaceae) and one Oriental species has been bred from *Clerodendron* (Verbenaceae).

Five species are known from Madagascar. Their specific names are derived from their type-localities. *M. andobana* and *M. tsaratanana* appear to be related to Oriental species, whilst *M. mailaka, M. perineta* and *M. sandrangato* appear to be related to the African species.

Myoleja andobana sp. nov., Figs 11–12

This species is easily separated from all others in the genus by its distinctive wing pattern, having the costal cells dark, two hyaline indentations in the marginal cell and a hyaline posterior margin. The wings are narrow, as in several Oriental species.

FEMALE. Length of body (excluding ovipositor), 3,1 mm; of wing 3,7 mm.

Head. Length : height : width: 1 : 1,55 : 1,7; red-brown. Frons 0,27 times width of head; bristles black, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles moderately developed but thin; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face red-brown, with an elongate, median fulvous spot. Antennae shorter than face, red-brown; third segment apically rounded; arista with long pubescence. Occiput flat, with a row of thin, black occipital bristles.

Thorax. Mesonotum shining blackish-brown with fine pubescence. Pleura blackish-brown with no pale areas. Postnotum and scutellum shining blackish-brown.

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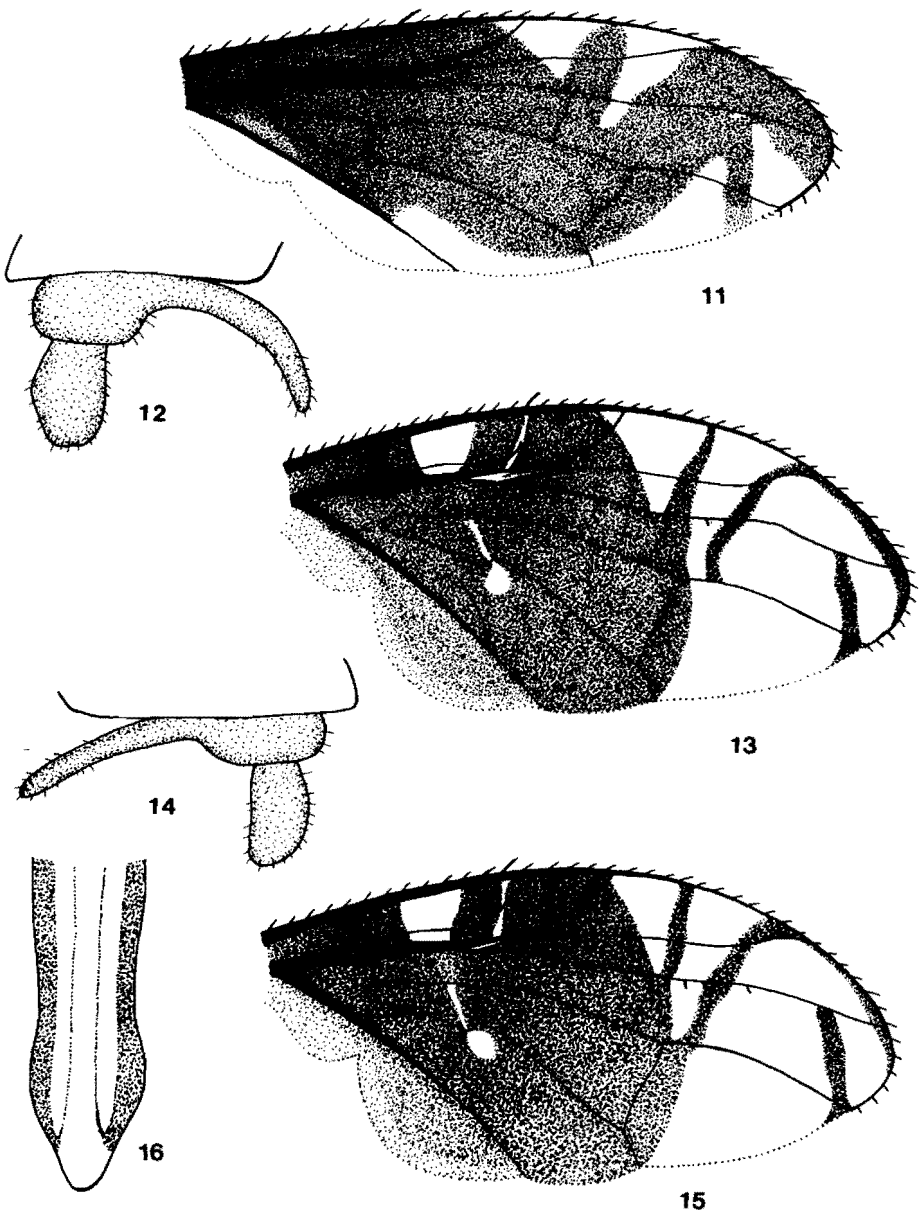

Figs. 11–16. 11–12. *Myoleja andobana* **sp. nov.** 11. Wing of female. 12. Lateral view of male genitalia. 13–16 *Myoleja mailaka* **sp. nov.** 13. Wing of male. 14. Lateral view of male genitalia. 15. Wing of female. 16. Aculeus.

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Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorscocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed behind the line of the anterior supra-alars. Legs with femora dark brown, tibiae and tarsi fulvous; middle tibiae with an apical black spine. Halteres blackish-brown. Wing (Fig. 11) elongate, with vein R_{4+5} setulose, r-m cross-vein beyond middle of discal cell, i-m cross-vein straight, slightly oblique outwardly; pattern blackish-brown, with two triangular hyaline indentations in marginal cell beyond stigma, the outer one larger and crossing vein R_{4+5}, a hyaline indentation in first posterior cell and another in second posterior cell, extending into first posterior cell and continuing along posterior margin of wing to base; anal cell acuminate.

Abdomen. Subtrinagular; shining blackish-brown with fine pubescence and with long setae along apical margins of segments. Oviscape concial, short, length 0,4 mm; aculeus not extruded.

MALE. Length of body, 3,1 mm; of wing, 3,7 mm. Similar to female. Male genitalia (Fig. 12) blackish-brown.

MATERIAL EXAMINED. Holotype ♀: MADAGASCAR (WEST): Andobo, forêt Antsingy, Antsalova district, ii.1957, P. Griveaud; 1 ♂ paratype, same data as holotype (both MHN).

Myoleja mailaka sp. nov., Fig 13–16

The broad wings and pattern of this species resemble those of the African mainland species and some from South-east Asia, but the large hyaline spot in the costal cell and minor details of the wing pattern readily separate it. From *M. sandrangato* it differs in the broad wings and partially fulvous hind tibiae, and from *M. perineta* it differs primarily in the rounded shape of the hyaline spot at the base of the third posterior cell.

MALE. Length of body, 3,4 mm; of wing, 3,5 mm.

Head. Length : height : width: 1 : 1,7 : 2; red-brown. Frons 0,28 times width of head; bristles black, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles weak; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face red-brown, fulvous medially and shining grey beneath the antennae. Antennae shorter than face, fulvous; third segment apically rounded; arista pubescent. Occiput flat, with a row of thin, black occipital bristles.

Thorax. Mesonotum shining blackish-brown with fine pubescence. Pleura blackish-brown with no pale areas. Postnotum and scutellum shining blackish-brown. Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed behind the line of the anterior supra-alars. Legs with femora and basal halves of mid and hind tibiae dark brown, remainder fulvous; middle tibiae with 1 long and 2 short apical black spines. Halteres blackish-brown. Wing (Fig. 13) broad, with vein R_{4+5} setulose, r-m cross-vein beyond middle of discal cell, i-m cross-vein almost at right angles to vein M_{1+2}; pattern blackish-brown with hyaline markings as follows: a large quadrate spot

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in second costal cell, a round spot at base of third posterior cell, a triangular indentation in marginal cell reaching to top of r-m cross-vein, most of apical portion of wing except for two narrow dark bands, one shaped as an inverted U above vein M_{1+2}, running along the wing margin apically, the second a diagonal median band in the first posterior cell; anal cell acuminate.

Abdomen. Subtriangular; shining blackish-brown with fine pubescence and with long setae along apical margins of segments. Male genitalia (Fig. 14) blackish-brown.

FEMALE. Length of body, 3,4 mm; of wing, 3,4 mm. Similar to male but wing (Fig. 15) with the inverted U-shaped band connected with the basal dark area at vein M_{1+2}. Oviscape blackish-brown, flattened, length 0,8 mm; aculeus (Fig. 16) fulvous, slightly expanded before tip and with a blunt apex.

MATERIAL EXAMINED. Holotype ♂: MADAGASCAR (SAMBIRANO): Mailaka, i.1952, N. L. H. Krauss; 3 ♀ paratypes, same data as holotype (all NCI).

Myoleja perineta sp. nov., Figs 17–19

As in the case of *M. mailaka*, the large hyaline spot in the costal cell and wing pattern details separate this species from other similarly-patterned, boad-winged species. From *M. mailaka* this species differs primarily in the elongate shape of the hyaline streak at the base of the third posterior cell.

MALE. Length of body, holotype 4,2 mm, paratype 3,0 mm; of wing, holotype 4,9 mm, paratype 3,5 mm.

Head. Length : height : width : 1 : 1,6 : 2; red-brown. Frons 0,27 times width of head; bristles black, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles weak; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face red-brown, paler medially. Antennae shorter than face, red-brown; third segment apically rounded; arista pubescent. Occiput flat, with a row of thin, black occipital bristles.

Thorax. Mesonotum shining blackish-brown with fine pubescence. Pleura blackish-brown with no pale areas. Postnotum and scutellum shining blackish-brown. Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed behind the line of the anterior supra-alars. Legs with femora and basal halves of mid and hind tibiae dark brown, remainder fulvous; middle tibiae with 1 long and 2 short apical black spines. Halteres blackish-brown. Wing (Fig 17) broad, with vein R_{4+5} setulose, r-m cross-vein beyond middle of discal cells, i-m cross-vein almost at right angles to vein M_{1+2}; pattern blackish-brown with hyaline markings as follows: a large squared spot in second costal cell, narrowly connected with an elongate and diagonal streak at base of third posterior cell, two triangular marginal indentations beyond stigma, the first stopping at vein R_{4+5}, the second almost reaching vein M_{1+2}, apical part of wing except for a narrow band along costa to apex and a diagonal medial band in the first posterior cell; alula hyaline; anal cell acuminate.

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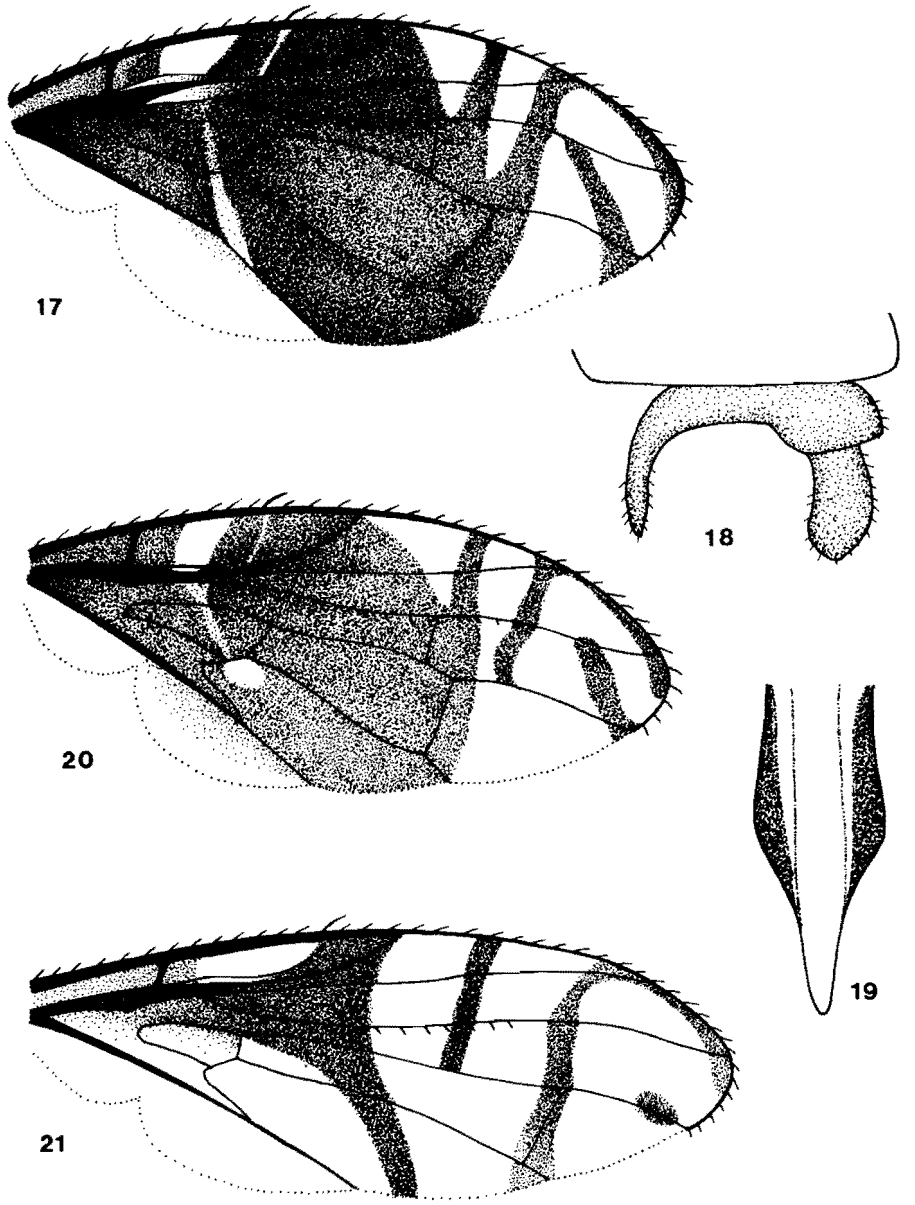

Figs. 17–21. 17–19. *Myoleja perineta* **sp. nov.** 17. Wing of male. 18. Lateral view of male genitalia. 19. Aculeus. 20. *Myoleja sandrangato* **sp. nov.**, wing of female. 21. *Myoleja tsaratanana* **sp. nov.**, wing of female.

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Abdomen. Subtriangular; shining blackish-brown with fine pubescence and with long setae along apical margins of segments. Male genitalia (Fig. 18) red-brown.

FEMALE. Length of body, 4,4 mm; of wing, 5,0 mm. Similar to male. Oviscape flattened, length 0,3 mm; aculeus (Fig. 19) fulvous, smooth, slightly expanded before tip, drawn out to a long point.

MATERIAL EXAMINED. Holotype ♂: MADAGASCAR (EAST): Perinet (Moramanga district); 1 ♀ paratype, same data as holotype (both MHN). (WEST): 1 ♂ paratype, Hera, Ankazoabo district (NCI).

Myoleja sandrangato sp. nov., Fig. 20

This species is very similar to *M. mailaka* in wing pattern but the wings are narrower and the hind tibiae entirely brown. The female (male unknown) also differs from that of *M. mailaka* in having the inverted U-shaped subapical band free from the basal dark area at vein M_{1+2}.

FEMALE. Length of body (excluding ovipositor), 2,3 mm; of wing, 2,7 mm.

Head. Length : height : width : 1 : 1,6 : 2; red-brown. Frons 0,31 times width of head; bristles black, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles weak; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristles present. Face red-brown. Antennae shorter than face, red-brown; third segment apically rounded; arista pubescent. Occiput flat, with a row of thin, black occipital bristles.

Thorax. Mesonotum shining blackish-brown with fine pubescence. Pleura blackish-brown with no pale areas. Postnotum and scutellum shining blackish-brown. Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed behind the line of the anterior supra-alars. Legs with femora, hind tibiae and basal halves of mid tibiae dark brown, remainder fulvous; middle tibiae with an apical black spine. Halteres blackish-brown. Wing (Fig. 20) relatively narrow, with vein R_{4+5} setulose, r-m cross-vein beyond middle of discal cell, i-m cross-vein almost at right angles to vein M_{1+2}; pattern blackish-brown with hyaline markings as follows: a large quadrate spot in second costal cell, a round spot at base of third posterior cell, a triangular indentation in marginal cell reaching to top of r-m cross-vein, most of apical portion of wing except for two narrow dark bands, one shaped as an inverted U above vein M_{1+2}, running along the wing margin apically, the second a diagonal medial band in the first posterior cell; anal cell acuminate.

Abdomen. Subtriangular; shining blackish-brown with fine pubescence and with long setae along apical margins of segments. Oviscape flattened, length 0,4 mm; aculeus not extruded.

MALE. Unknown.

MATERIAL EXAMINED. Holotype ♀: MADAGASCAR (EAST): Sandrangato (Moramanga district)) (MHN).

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Myoleja tsaratanana sp. nov., Fig. 21

This is a large species with narrow wings and the brown wing-band through r-m cross-vein separated from the brown basal area. In these characters, and in the well developed setae on the fore femora and hind tibiae, it resembles the Oriental *M. setigera* Hardy, but differs in the blacker body, longer oviscape and the brown wing-band through r-m cross-vein also being free from the basal brown area.

FEMALE. Length of body (excluding ovipositor), 7,0 mm; of wing, 7,5 mm.

Head. Length : height : width : 1 : 1,7 : 2; red-brown. Frons narrowing slightly anteriorly, 0,33 times width of head at widest part, with numerous fine setae; bristles black, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles very weak; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face dark red-brown. Antennae shorter than face, red-brown; third segment apically rounded; arista with very short pubescence. Occiput flat dorsally, moderately swollen ventrally, with a row of long black occipital bristles and numerous black setae on swollen part.

Thorax. Mesonotum black with dense, fine dark pubescence. Pleura black except propleura red-brown. Postnotum and scutellum black. Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed well behind the line of the anterior supra-alars; a row of 6 strong and several weaker black setae on propleura. Legs red-brown with femora and hind tibiae a little darker; fore femora with dense, long black setae posteriorly; middle tibiae with three apical black spines, the middle spine the longest; hind tibiae with a row of long black dorsal setae. Halteres red-brown. Wing (Fig. 21) narrow, with vein R_{4+5} setulose, r-m cross-vein beyond middle of discal cell, i-m cross-vein almost at right angles to vein M_{1+2}; largely hyaline with the base fulvous, merging to dark brown below the stigma but leaving most of the second costal cell hyaline, and with brown bands as follows: from stigma to wing margin, united with the basal area below the stigma above vein M_{1+2}, a narrow band from costa, through r-m cross-vein, to M_{1+2}, a narrow band from wing margin, through i-m cross-vein, to apex of marginal cell and along costa to apex of wing; a small dark spot over vein M_{1+2} near its apex; anal cell acuminate.

Abdomen. Subtriangular; black with fine pubescence and with long setae along apical margins of segments. Oviscape black, flattened, long, length 3,1 mm; aculeus not extruded.

MALE. Unknown.

MATERIAL EXAMINED. Holotype ♀; MADAGASCAR (NORTH): Massif du Tsaratanana, en dessous de l'Andohanisambirana, Matsabory, 1900 m, xii.1964, P. Soga (MHN).

Genus *ACIDOXANTHA* Hendel

This Oriental genus is recorded for the first time from the Afrotropical Region. Host plants of the new species are not known but several Oriental species are

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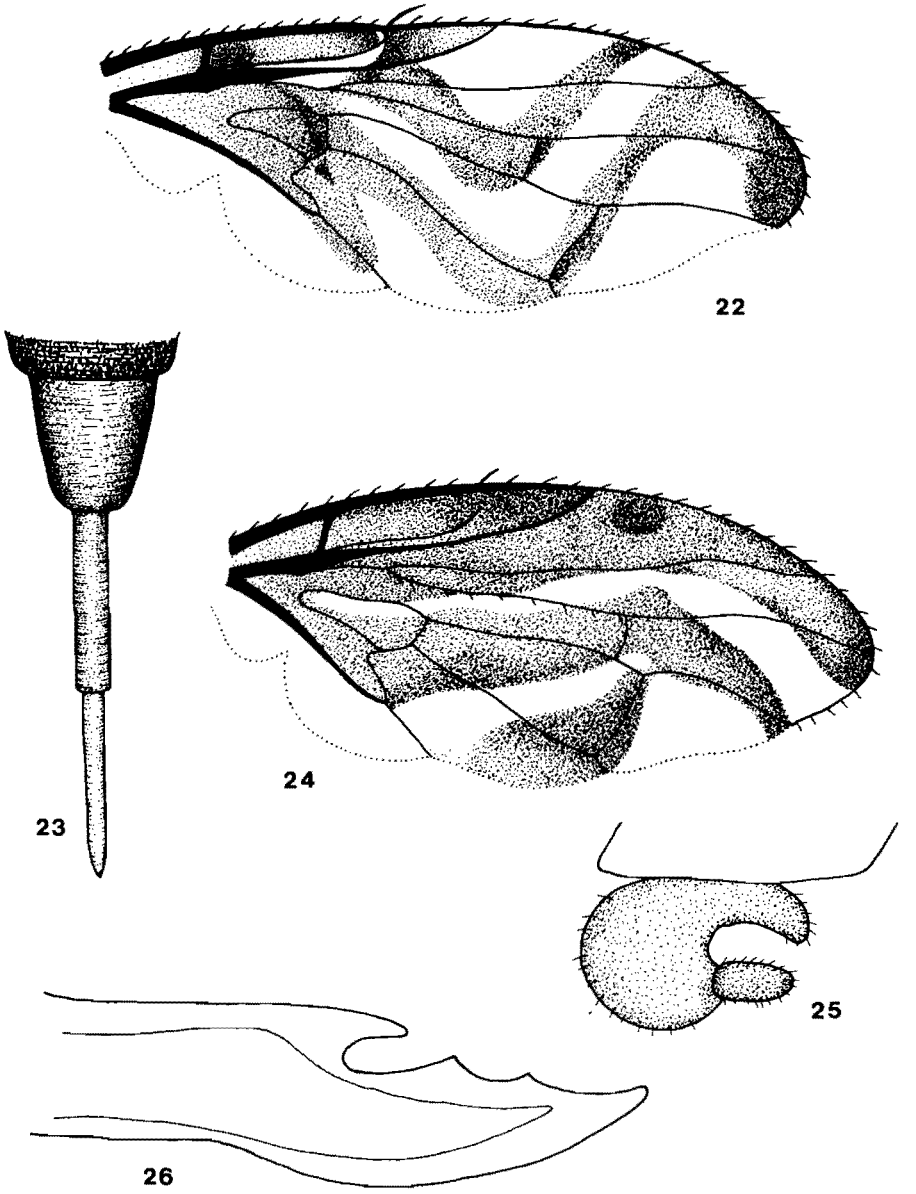

Figs. 22–26. 22–23. *Acidoxantha bisinuata* **sp. nov.** 22. Wing of female. 23. Ovipositor. 24–26. *Notomma munroi* **sp. nov.** 24. Wing of male. 25. Lateral view of male genitalia. 26. Lateral view of aculeus.

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known to infest the buds of large flowers such as *Bombax* (Bombacaceae), *Hibiscus* (Malvaceae) and *Bauhinia* (Leguminosae).

Acidoxantha bisinuata sp. nov., Figs 22–23

The fulvous bristles, 2 inferior orbitals, bare vein R_{4+5}, wing pattern and needle-like ovipositor enable this species to be placed in *Acidoxantha*. It differs from the other species in the genus by the wing pattern, having the yellow band through i-m cross-vein connected with the basal area along vein M_{3+4}, and the band through r-m cross-vein V rather than Y-shaped, stopping short of vein M_{3+4}.

The specific name is derived from the shape of the wing bands.

FEMALE. Length of body (excluding ovipositor), 4,1 mm; of wing, 4,0 mm.

Head. Length : height : width : 1 : 1,6 : 1,7; fulvous. Frons narrowing slightly anteriorly, 0,35 times width of head at widest part; bristles fulvous, 2 inferior orbitals (lower bristle absent), 2 superior orbitals. Lunule large, semicircular. Ocellar triangle fulvous, ocellar bristles absent; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair, fulvous; postverticals present. Genal bristle present. Face fulvous, unmarked. Antennae shorter than face, fulvous; second segment with a dorsal black seta; third segment apically rounded; arista with microscopic pubescence. Occiput flat, with a row of thin, fulvous occipital bristles.

Thorax. Mesonotum fulvous with fine pubescence, unmarked except for two pairs of dark brown dorsolateral spots, one pair before the suture and the other before the scutellum. Pleura fulvous. Postnotum and scutellum fulvous. Bristles well developed and fulvous: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed behind the line of the anterior supra-alars. Legs fulvous; middle tibiae with 2 long and 1 short apical dark fulvous spines. Halteres fulvous. Wing (Fig. 22) with vein R_{4+5} bare, r-m cross-vein beyond middle of discal cell, i-m cross-vein straight, slightly oblique outwardly; hyaline with yellow markings as follows: basal area, extending as a V-shaped band from stigma to r-m cross-vein to costa, and extending along vein M_{3+4} to i-m cross-vein then through that vein to apex of marginal cell, continuing along costa to wing apex, where the band becomes pale brown, and also extending along anal vein but ending in a point before wing margin; anal cell acuminate; costal bristle at base of stigma well developed.

Abdomen. Rounded; fulvous with fine pubescence. Segments 3 to 5 each have a pair of subdorsal dark brown spots anteriorly, whilst segments 4 to 6 each have a pair of lateral dark brown spots posteriorly, those on segment 6 small. Segment 6 large, as long as segment 5. Ovipositor (Fig. 23) with oviscape short, red-brown, length 0,55 mm; second segment elongate; aculeus elongate, needle-like, pointed at tip.

MALE. Unknown.

MATERIAL EXAMINED. Holotype ♀: MADAGASCAR (WEST): Station Agric., Bas Mangoky (Morombe district) (MHN).

Genus *NOTOMMA* Bezzi

The six species currently placed in this Afrotropical genus were revised by Munro (1952). The biologies of only two of the species are known: *N. galbanum* Munro

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forms galls on twigs of *Dicrostachys cinerea* (= *glomerata*), whilst *N. jucundum* (Loew) has been bred from galls on twigs of *Acacia gerrardii* in Zimbabwe. Both these host plants belong to the Leguminosae and the form of the ovipositor suggests that other species of *Notomma* also form galls on the twigs of *Acacia* or related genera.

Notomma munroi sp. nov., Figs 24–26

This species is very similar in appearance to *N. bioculatum* Bezzi, but has the hind marginal wing band, through i-m cross-vein, broader, and a differently shaped aculeus.

This species is named after Dr H. K. Munro, in recognition of his major contributions to the study of African Tephritidae.

MALE. Length of body, 5,8 mm; of wing, 6,0 mm.

Head. Length : height : width : 1 : 1,6 : 2; fulvous. Frons narrowing slightly anteriorly, 0,30 times width of head at widest part; bristles black, 3 inferior orbitals, 2 superior orbitals. Lunule large, semicircular. Ocellar triangle black, ocellar bristles moderately developed; postocellars present. Vertex with inner and outer vertical bristles well developed, especially inner pair; postverticals present. Genal bristle present. Face fulvous, unmarked. Antennae shorter than face, fulvous; third segment apically rounded; arista bare. Occiput flat, with a row of thin, black occipital bristles.

Thorax. Mesonotum pale red-brown with dense, fine pubescence; a pair of dorsolateral dark spots across suture, covered in dark pubescence. Pleura fulvous. Postnotum brown. Scutellum fulvous with 2 or 3 indistinct darker spots along posterior edge. Bristles well developed and black: 4 scapulars, 1 humeral, 1 presutural, 2 notopleurals, 1 anterior supra-alar, 2 posterior supra-alars, 2 dorsocentrals, 2 prescutellars, 2 mesopleurals, 1 pteropleural, 1 sternopleural, 4 scutellars; dorsocentrals placed well behind the line of the anterior supra-alars, close to prescutellars. Legs fulvous; middle tibiae with 1 long and 2 short apical black spines. Halteres fulvous. Wing (Fig. 24) with vein R_{4+5} setulose to r-m cross-vein, densest at base, r-m cross-vein beyond middle of discal cell, i-m cross-vein almost at right angles to vein M_{1+2}; hyaline with yellow bands as follows: anteriorly, along costa from base to apex, centrally, from anal cell through r-m cross-vein to margin at end of vein M_{1+2}, posteriorly, from top of i-m cross-vein to posterior wing margin and along margin to anal vein; at the wing apex, end of vein M_{1+2} and along posterior margin the bands become brown and there is a brown spot in the marginal cell; anal cell acuminate.

Abdomen. Rounded; red-brown with fine pubescence. Male genitalia (Fig. 25) dark fulvous, robust.

FEMALE. Length of body, 4,6–5,3 mm; of wing, 5,4–6,0 mm. Similar to male but wing with anterior and central yellow bands connected by a bar above r-m cross-vein. Oviscape conical, red-brown to blackish-brown, laterally compressed and black at tip, length 1,1–1,25 mm; second segment fulvous to red-brown; aculeus (Fig. 26) red-brown, laterally compressed, apically pointed and with a dorsal spine and two small dorsal teeth.

MATERIAL EXAMINED. Holotype ♂: MADAGASCAR (EAST): Perinet (Moramanga district); 1 ♀ paratype, same data as holotype (both MHN); 1 ♀ paratype, Sandrangato (Moramanga district) (NCI).

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Insects in association with the inflorescence of *Protea repens* (L.) (Proteaceae) and their role in pollination

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A survey was carried out on insects found in the inflorescences of *Protea repens* (L.) L. which flowers between March and July in the Western Cape. A total of 45 insect species was recorded of which 32 were Coleoptera. *Chirodica* spp. (Halticidae) comprised 70% of all the insects found. Exclusion experiments and scanning electron microscope photographs show that small beetles are important vectors of protea pollen — a role hitherto attributed only to birds, rodents and large beetles.

INTRODUCTION

The role played by pollen vectors in the family Proteaceae has received considerable attention over the past few years (Paton & Ford 1976; Rourke & Wiens 1977; Wiens & Rourke 1978; Hopper 1980; Mostert *et al.* 1980; Lamont 1982; Vogts 1982; Wiens *et al.* 1983). The individual florets in the inflorescence of the genus *Protea* are self-sterile, and as wind cannot pollinate the flowers (Horn 1962) another vector is necessary to transfer the pollen from the pollen presenter to the open stigma. Rodents were shown to be the main pollen carriers of the cryptic, geoflorous species of *Protea* (Rourke & Wiens 1977; Wiens *et al.* 1983), and it is generally accepted that sugar birds, namely *Promerops cafer* (L.) and *P. gurneyi* Verreaux, are responsible for pollinating the taller *Protea* species (Skead 1967; Vogts 1982). The role played by insects in the pollination of the Proteaceae has not been investigated, although Gess (1969), Myburgh *et al.* (1973) and others mentioned the large number of insects in association with the inflorescences of proteas. The only positive indications that insects are involved, were given by Carolin (1965) and Lamont (1982) who worked on Australian Proteaceae.

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